

WHAT IS CLAIMED IS:

1. A flow regulating valve having a valve element operably disposed in a flow channel and being capable of regulating the flow of a fluid according to the valve opening degree of the valve element, comprising:

a stress detecting means for detecting the flow-channel-direction force component of a load applied to the valve element by the fluid; and

a valve opening degree detecting means for detecting the degree of opening of the valve element.

2. The flow regulating valve as set forth in Claim 1, wherein the valve element is constructed to be rotatable around an axis that intersects said flow-channel direction.

3. The flow regulating valve as set forth in Claim 1 or 2, wherein said stress detecting means includes a detector which is able to detect a force, relative displacement or relative strain between said valve element or a member fixed at least in said flow-channel direction with respect to said valve element and a housing which rotatably and axially supports said valve element or a member fixed at least in the flow-channel direction with respect to the corresponding housing.

4. A flow rate measuring device comprising:

a flow regulating valve which is provided with a valve

element operably disposed in a flow channel and is capable of regulating the flow of fluid according to the valve opening degree of the corresponding valve element;

a stress detecting means for detecting said flow-channel-direction force component of a load applied to said valve element by the fluid;

a valve opening degree detecting means for detecting the valve opening degree of said valve element; and

a flow rate calculating means for obtaining a flow rate of said fluid by using said force component detected by said stress detecting means and said valve opening degree detected by said valve opening degree detecting means.

5. The flow rate measuring device as set forth in Claim 4, wherein said valve element is rotatably constructed around an axis intersecting the flow-channel direction.

6. The flow rate measuring device as set forth in Claim 4 or 5, wherein said stress detecting means includes a detector which is able to detect a force, relative displacement or relative strain between said valve element or a member fixed at least in said flow-channel direction with respect to said valve element and a housing which rotatably and axially supports said valve element or a member fixed at least in the flow-channel direction with respect to the corresponding housing.

7. The flow rate measuring device as set forth in Claim 4 or 5, wherein said flow rate calculating means includes a differential pressure converting means for obtaining a differential pressure between the upstream side and downstream side of said valve element on the basis of said force component, and a flow rate converting means for obtaining said flow rate on the basis of said differential pressure and valve opening degree.

8. A flow control device comprising:

a flow regulating valve which is provided with a valve element operably disposed in a flow channel and is capable of regulating the flow of fluid according to the valve opening degree of the corresponding valve element;

a stress detecting means for detecting said flow-channel-direction force component of a load applied to said valve element by the fluid;

a valve opening degree detecting means for detecting the valve opening degree of said valve element;

a valve element driving means for driving said valve element;

a flow rate calculating means for obtaining a flow rate of said fluid by using said force component detected by said stress detecting means and said valve opening degree detected

by said valve opening degree detecting means; and

a valve opening degree control means for controlling said valve element driving means in response to said flow rate.

9. The flow control device as set forth in Claim 8, wherein the valve element is constructed to be rotatable around an axis intersecting said flow-channel direction.

10. The flow control device as set forth in Claim 8 or 9, wherein said stress detecting means includes a detector which is able to detect a force, relative displacement or relative strain between said valve element or a member fixed at least in said flow-channel direction with respect to said valve element and a housing which rotatably and axially supports said valve element or a member fixed at least in the flow-channel direction with respect to the corresponding housing.

11. The flow control device as set forth in Claim 8 or 9, wherein said flow rate calculating means includes a differential pressure converting means for obtaining a differential pressure between the upstream side and downstream side of said valve element on the basis of said force component, and a flow rate converting means for obtaining said flow rate on the basis of said differential pressure and valve opening degree.

12. The flow control device as set forth in Claim 8 or 9, wherein the valve opening degree control means is constructed

so as to control said valve element driving means by comparing an integrated flow rate obtained by integrating said flow rate and a desired value thereof with each other.

13. A flow rate measuring method comprising the steps of:

detecting a valve opening degree with respect to a flow regulating valve that is provided with a valve element operably disposed in a flow channel and is capable of regulating the flow of fluid according to the valve opening degree of the corresponding valve element;

simultaneously detecting said flow-channel-direction force component applied to the above valve element by the fluid; and

obtaining said flow rate on the basis of said valve opening degree and said force component.

14. The flow rate measuring method as set forth in Claim 13, wherein said flow rate calculating means obtains a differential pressure between the upstream side and downstream side on the basis of said force component and obtains said flow rate on the basis of the corresponding differential pressure and said valve opening degree.